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ABSTRACT

Texts on measurement theory report many studies on the consistency of intelligence test scores, but the stability of academic achievement over the school years has never been adequately studied. To investigate the stability of achievement test scores from fourth grade to college, a random sample of 100 students was selected from a 1978 graduating class. Achievement test scores from the Scholastic Testing Service Educational Development Series were available on each subject from fourth, sixth, eighth, and tenth grade. Teacher-assigned grades, ACT scores of 37 students, and first semester college grades for 31 students were also analyzed. Results of multiple regression analyses showed that fourth grade scores were powerful predictors of tenth grade level performance, demonstrating the stability of achievement tests. Results also showed that teacher-assigned grades were limited in reliability and validity. An examination of the instability of achievement test scores for individuals from fourth to tenth grade illustrated that, in general, the closer the grade levels, the smaller the amount of variability for individuals from year to year. Findings indicate that early school functioning predicts later school functioning in a powerful manner, suggesting that remediation of deficiencies in the early grades is critical for a child's later academic progress. (JAC)

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The Stability and Validity of Academic Achievement

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The Stability and Validity

of Academic Achievement

Although Jencks (1972) claimed that test scores as early as sixth grade predict later educational attainment and are important to later occupational status, the stability of academic achievement over the school years has never been adequately studied. Texts on measurement theory (cf. Anastasi, 1982) report many studies on the consistency of intelligence test scores, but the chapters on achievement tests lack citations concerning the stability of these measures. That early school achievement will be predictive of later achievement is accepted as fact but adequate scientific demonstrations appear to be lacking.

The purpose of this study, therefore, was to investigate the stability of achievement test scores from fourth grade to college. A random sample of one hundred students was selected from a 1978 graduating class of approximately 2000. Achievement test scores of the Scholastic Testing Service Educational Development Series (1975 edition) were available on each subject from fourth, sixth, eighth and tenth grade. Standard multiple regression analyses were computed with fourth grade scores in Reading, English, Math, non-verbal skills, verbal skills, intelligence and composite score as predictors of tenth grade Reading, English, Math, and composite achievement test scores. Teacher grades for fourth, sixth, eighth, and tenth grades were correlated with achievement test scores in Reading, English, and Math. The ACT scores (administered in 11th grade) of 37 students was correlated with tenth grade achievement scores in English, Math, Social

Studies, Science, and the composite. Both the ACT composite and the 10th grade achievement test composite were correlated with first semester GPA for 31 students who gave written permission to obtain their records from a local university.

Patterning this study on intelligence test research, the instability of achievement test scores for individuals from one administration to the next was examined. In order to examine individual variations, achievement test scores for the sample of 100 subjects were converted to standard scores at 4th, 6th, 8th, and 10th grade level. Each students' obtained score was subtracted from the mean for each subject matter area. This provided a difference score which represented each students' deviation from the average in each area for that year. By computing the deviations from the mean for each individual student from fourth to sixth, sixth to eighth, and eighth to tenth grade, it was possible to determine the percentage of individuals who varied from year to year on their scores for each subject area. Percentages of students who were $\pm$ 1S.D. or more and $\pm$ ½ S.D. or more from the previous performance was tabulated to quantify instability for individuals.

Results and Discussion

The Tables contain a summary of the multiple regression analyses using fourth grade achievement scores as predictors of tenth grade Reading, English, Math, and composite achievement scores. The four equations were all significant at the .001 level of confidence, demonstrating that fourth grade scores are powerful predictors of tenth grade level performance and account for a majority of the

variance in every case. The specific subject matter score at fourth grade level, i.e., English, Reading, or Math, is by itself a powerful predictor of performance in each specific area. The weakest predictor of tenth grade performance is non-verbal skills, but it is still a significant predictor. General ability or IQ would also be a powerful predictor considered by itself, but the composite accounts for a slightly higher percentage of the variance. Though not presented in the tables, separate regression analyses using sixth grade and eighth grade scores as predictors of tenth grade scores illustrated a progressive increase in the magnitude of the variance which can be specified for tenth grade achievement scores. Eighth grade scores are more powerful predictors of tenth grade scores than fourth grade scores.

In order to eliminate the confounding effect of verbal skills scores, non-verbal skill scores, IQ (general ability) and the composite in the prediction of fourth to tenth grade functioning, standard multiple regression analyses (not given in the tables) were also computed using fourth grade Reading, English, and Math achievement scores as predictors of tenth grade Reading, Spelling, and Math achievement. The equations were all significant at .001 level and each equation accounted for only about 2% less variance than the equations presented in the tables. Using the Darlington (1968) technique, the most useful or meaningful predictor of tenth grade Reading in these equations was fourth grade Reading, of tenth grade Math was fourth grade Math, but fourth grade Reading was the most useful predictor of tenth grade English.

The results of these regression analyses demonstrate the stability of achievement tests. They are as stable, if not more so, than IQ tests. Early school functioning predicts later school functioning in a very powerful manner. Remediation of deficiencies in the early grades is critical for a child's later academic progress.

In order to examine the relationship between standardized achievement tests and teacher assigned grades (for the total school year), correlations were computed (see tables). The correlations are significant $p < .01$ for 4th, 6th, 8th, and 10th grades. These moderate correlations agree with previous research and reflect the fact that teacher grades are limited in reliability and validity; the 100 students in this sample were in many different schools and were probably assigned grades based on multiple criteria. The consistency of the relationships between teacher grades and achievement tests supports the concurrent validity of achievement tests while at the same time demonstrating that there is a great deal of unspecified variance between teacher grades and achievement test scores.

The next procedure involved correlating the 10th grade achievement scores and ACT scores for 37 of these students (11th graders) (refer to tables). It illustrates that achievement test scores correlate more highly with other achievement scores than with teacher grades. The domain sampled by the STS-EDS tenth grade achievement and the ACT are very comparable. Even fourth grade achievement scores in English, Math, and the Composite correlate significantly with the 11th grade ACT:English, .36, Math, .33, and Composite, .37. All are significant at the .05 level.

The next step traced those students in the sample of 100 who had taken the ACT in 10th, 11th, or 12th grade and chosen to attend the local state university. Letters were sent to forty-four students requesting permission to retrieve their first semester GPA for research purposes. Thirty-one gave permission. Their ACT composite was correlated with their first semester GPA resulting in a correlation of .46 ($p < .05$). Their 10th grade STS-EDS composite correlated .42 (N.S) with the first semester GPA.

Patterning this study on IQ research, an attempt was made to examine the instability of achievement test scores for individuals from 4th to 10th grade. Results indicate that 31% of students increase or decrease $\pm$ 1 S.D. in Reading from 4th to 10th grades; 45% deviate $\pm$ ½ S.D.; 55% therefore deviate less than $\pm$ ½ S.D. In Math 14% deviate $\pm$ 1 S.D. from 4th to 10th grade; 39% deviate $\pm$ ½ S.D. in Math 61% deviate less than $\pm$ ½ S.D. in Math. In English 22% of the students deviate $\pm$ 1 S.D. from 4th to 10th grade; 44% deviate $\pm$ ½ S.D.; 56% therefore deviate less than $\pm$ ½ S.D. Only 9% vary $\pm$ 1 S.D. on the composite from 4th to 10th grade; 21% vary $\pm$ ½ S.D.; 79% of the students deviate less than $\pm$½ S.D. from 4th to 10th grade. Computations for 4th to 6th, 6th to 8th, and 8th to 10th illustrate that in general, the closer the grade levels, the smaller the amount of variability for individuals from year to year. Compared to IQ scores (cf. Anastasi 1982), achievement test scores show less variability from one administration to the next. The majority of students are very consistent from year to year. Fluctuations of ½ S.D. can be considered neglible over two years and even less important over

four years. Fluctuations in the composite score from fourth to tenth grade with only 9% of the students being ± 1 S.D. from their original level is amazing in its consistency.

References

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Jencks, C. (et.al.). Inequality: a reassessment of the effect of family and schooling in America. New York: Basic Books, 1972.

Achievement Score Stability
(n = 100)

4th Grade Achievement Scores as predictors of 10th Grade Reading Achievement Score	4th Grade Achievement Scores as predictors of 10th Grade English Achievement Score	4th Grade Achievement Scores as predictors of 10th Grade Math Achievement Score	4th Grade Achievement Scores as predictors of 10th Grade Composite Achievement Score
F = 13.96	F = 24.77	F = 17.91	F = 26.48
df (7, 92)	df (7, 92)	df (7, 92)	df (7, 92)
Multiple R = .74	Multiple R = .83	Multiple R = .78	Multiple R = .84
R^2 = .55	R^2 = .68	R^2 = .61	R^2 = .70
Zero Order Correlations with the criterion	Zero Order Correlations with the criterion	Zero Order Correlations with the criterion	Zero Order Correlations with the criterion
Composite .72	Composite .81	Composite .74	Composite .82
IQ .64	IQ .73	IQ .69	IQ .77
Non-verbal .43	Non-verbal .51	Non-verbal .49	Non-verbal .55
Verbal .71	Verbal .76	Verbal .70	Verbal .79
Reading .69	Reading .77	Reading .63	Reading .74
English .57	English .73	English .68	English .70
Math .64	Math .70	Math .73	Math .73
4th Grade Achievement Scores with teacher Grades	6th Grade Achievement Scores with teacher Grades	8th Grade Achievement Scores with teacher Teacher Grades	10th Grade Achievement Scores with teacher Teacher Grades
Reading r = .35	Reading r = .39	Reading r = .36	
English r = .31	English r = .40	English r = .34	English r = .44
Math r = .37	Math r = .36	Math r = .43	Math r = .46

Correlations between 10th grade achievement scores and 11 grade ACT (n = 37)

English	.57	Composite .68
Math	.64	
Social Studies	.59	
Natural Science	.63	